Is a sustainable future possible?

Is a sustainable future possible?

Y V Anikin[1], V I Shilkov[2]

[1]Department of water treatment, Ural Federal University, Mira str., 19, Ekaterinburg, 62002, Russia
[2] Graduate School of Economics and Management, Ural Federal University, Mira str., 19, Ekaterinburg, 62002, Russia

E-mail: anikin-urfu@yandex.ru

Abstract. The article presents the issues of transition to a sustainable balanced development of economic systems, taking into account the minimization of environmental losses. A thesis on the internal contradictions of modern economic models is proposed. Problems and negative consequences of the introduction of new technologies are noted. The problems of the interaction of economics and ecology are analyzed. The main obstacles to the transition to sustainable development and a green economy are identified.

1. Introduction

The discussion of the transition to a sustainable environmentally balanced development and a green economy has been taking place over the past few decades.

Environmental scientists, various social movements and the media have long paid attention to the problem of irreversible changes in the environment, which are largely due to negative anthropogenic influences.

Today, it is still possible to argue about whether warming is really coming or, conversely, cooling in the future, but the effects of climate change are often enough to show themselves and thus give rise to a serious discussion of the expected consequences. In the same row are the problems of depletion of energy resources (oil, gas, coal), pollution of surface and ground waters of the land and the World Ocean, air, soil, accumulation of production and consumption waste [1-8]. The modern economy in its most general sense is impossible without taking into account the laws and needs of ecology.

As noted in the report of the World Commission on Environment and Development in 1987, “Our Common Future” [9]: “The environment and the economy are increasingly intertwined with each other - at the local, regional, national and global levels - to form a complex cause and effect ... We do not predict the future; our task is to issue a warning - an urgent warning based on the latest and most reliable scientific data - that the time has come for making appropriate decisions that guarantee the preservation of the resources necessary for current and future generations”.

2. Sustainable development’s primary dimensions

In recent years, some authors have proposed various models of ecological and economic development. For example, in [10–11] models of a linear (traditional), fractional, cyclic, and green economy are proposed.

These models are characterized by different approaches to the consumption of resources and the processing of industrial and household waste.

An integral part and engine of economic growth is the innovation process. It is innovative technologies that provide access to new materials and types of energy that make it possible for all of humanity to reach new frontiers of economic development.

In connection with the threat of climate change on Earth and the exhaustion of traditional energy resources, it became clear that humanity needs to switch to renewable energy sources (RES).

Table 1 shows the dynamics of investments of countries of the world in renewable energy technologies according to [12-14].

Table 1. Global Trends in Technological Investment (RES), billion dollars

	2004	2006	2008	2010	2011	2012	2013	2014
Solar power	12.0	22.1	60.8	103.3	155.7	144.3	119.8	149.6
Wind power	17.9	39.6	75.2	98.9	84.2	84.1	89.3	99.5
Biomassa and sewage sludge for energy	7.4	12.1	16.9	16.0	17.4	12.4	9.3	8.4
Wood fuel	3.9	28.4	19.2	10.1	10.4	7.0	5.5	5.1
Hydropower <50 MW	2.6	7.6	7.8	5.7	7.2	6.4	5.5	4.5
Geothermal energy	1.2	1.5	1.7	3.0	3.7	1.8	2.2	2.7
Ocean energy	0.0	0.9	0.2	0.3	0.3	0.3	0.2	0.4
Total investment	45.1	112.1	181.8	237.2	278.8	256.4	231.8	270.2
Total installed capacity without hydropower, GW	85	207	200	315	390	480	560	665

As can be seen from Table 1, the trends in global investments in technologies for various types of renewable energy sources are quite heterogeneous. For example, there is almost constant growth in volumes on investments in solar energy, and for investments in biofuels and geothermal energy, fluctuations are observed.

The use of renewable energy is a progressive phenomenon and leads to a decrease in the use of limited natural resources. But on the other hand, quite often new technologies may lead to new dangerous consequences. For example, the use of renewable energy sources (wind, sun) is always presented as an undoubted advantage over the use of oil, gas, coal [15-16]. However, even if we briefly consider the individual pros and cons of renewable energy sources (Table 2), then, for example, for solar energy, negative aspects can be presented in more detail:

- use of toxic elements in the production of solar cells (lead, cadmium, gallium, arsenic, etc.). These elements may be released into the environment;
- battery efficiency is quite low (about 20 %), and 80 % of energy is spent in the form of heat into the surrounding space;
- a device for cooling and energy storage is required, since a large amount of energy is required in the evening and at night when batteries do not work;

In addition, large areas are required to accommodate solar cells. This causes a fairly high cost of 1 kW of energy, and the amount of energy produced by solar energy is less than 1 % of its total worldwide.

In [17] it is noted that “the accelerated development of renewable energy in Russia should be considered as an important factor in the modernization of the economy, including those related to the development of innovative industries, the development of new innovative technologies, the development of small and medium businesses, the creation of new jobs, the improvement of social conditions, improvement of ecology, etc.". Unfortunately, it should be noted that target indicators for the development of renewable energy sources suggest an increase in the share of renewable energy in

the country's energy balance by only 2.5% by 2020, which is noticeably less than that of the advanced countries in this area.

Table 2. Selected strengths and weaknesses of renewable energy sources

	POSITIVE EFFECTS	NEGATIVE EFFECTS
SOLAR PANELS	• uses an inexhaustible renewable energy source; • there are no pollutant emissions to the environment.	• high price • large footprint • the need to dispose of toxic waste
GEOTHERMAL SOURCES	• geothermal power plants are more environmentally friendly than thermal power plants	• access to underground sources requires drilling.
HYDROPOWER	• the cost of electricity at hydropower stations is significantly lower than at all other types of power plants	• construction of hydropower plants requires large capital expenditures • efficient hydro stations are far from consumers
SOURCES ON BIOFUEL	• use of agricultural waste, timber processing, food industry and municipal wastewater treatment plants	• reduction of acreage under food crops
Tidal Power Stations	• environmental friendliness and low cost of energy production	• power changes during the day
WIND POWER	• insignificant influence on biocenoses and living conditions of people; • no fuel costs	• weather dependence

In the present economic conditions, the planned terms of return on investments in RES technologies and the level of profitability of such projects are not attractive to investors. Also, no conditions have been created that would motivate Russian industrial enterprises to create new efficient equipment for the renewable energy sector. It is obvious that the influence of state policy in this direction, both as a whole in the country and in the regions, is still not enough.

The report [9] mentioned drought in African countries, which killed 1 million people, as one of the examples of the negative interaction of the economy and the environment. And such examples are not left in the past. Thus, for example, according to [18], for 35 years (from 1965 to 2000) about 4.4 billion people suffered from varying degrees from seven main types of natural disasters. The total economic losses over these 35 years amounted to 895 billion, including over the last decade – 676 billion dollars. It is noted that the greatest social risk (death and injury to people) is characteristic of countries with the lowest level of development. The growth of critical situations is caused not only by the increase in the human population on Earth, but also by the growth of technogenic impacts on the environment.

In subsequent years, mankind experienced a large number of both natural and man-made disasters [19–20]: accidents at nuclear facilities, oil spills from tankers and oil platforms, transportation and industrial disasters that caused significant damage to the global economy and the environment.

The arms race, military conflicts, and now the widespread spread of terrorism in the world also lead to environmental, economic and political crises in a number of countries.

Since the report of the World Commission, environmental pollution has also increased in the air, water environment and in the soil layer. The number of industrial and domestic wastes that are not recycled is growing. New types of pollution have emerged: electromagnetic, noise and light. Due to

the imperfection of technologies and the lack of an integrated approach in the development of mineral resources, coal and oil are not fully extracted, a large amount of associated gas is burned. A significant amount of valuable metals is removed to the dumps, the extraction of which is considered uneconomical. Treatment facilities of industrial enterprises and domestic wastewater occupy significant areas for non-utilizable waste.

3. Discussion of the results and conclusion

Why, despite the constant discussion of these problems at various levels, starting with the UN conferences and ending with the teaching of ecology in secondary and higher education, does the ecological situation continue to deteriorate?

In our opinion, the following contradictory trends can be singled out as the main obstacles to the transition to sustainable development and a green economy:

- human society is a “consumer society”, and consumption is impossible without constant growth and this is the road to a permanent negative impact on the environment. Most of the energy and material resources of the world economy goes to meet the secondary needs of a minority of the world's population;
- population growth leads to an increase in the negative impact on the environment, and growth restriction is impossible, since in most countries (including Russia) this growth is encouraged as one of the conditions for economic growth;
- inequality between developed and developing countries pushes the latter to economic and material growth, which, as a rule, is connected not with the use of advanced technologies, but with a negative impact on the environment (for example, unreasonable extraction and export of raw materials from developing countries without a forecast for the future);
- government agencies and commercial organizations directly related to economic problems, as a rule, are not directly related to environmental issues and are not interested in a global change in attitudes towards ecology, and current problems require a coherent, integrated approach;
- changes in ecology most seriously affect infrastructure systems (energy, water supply and others), which requires the development of models of their functioning in new conditions, and the modeling should take into account the interaction of infrastructures;
- it is necessary to carry out modeling of the functioning of social systems to determine the behavior of large masses of people in the face of serious environmental changes;
- a healthy environment, preserved for future generations, should be the goal of a green economy at all levels: global, national, regional and local.

References

[1] Kolosova O Yu 2013 Man and society in the face of global environmental problems *Conference SIC Sociosphere collections* **51** 40-43
[2] Kovrizhkina L N 2014 Ways of solving global environmental problems by creating a set of measures for environmental safety *Bulletin of the South Ural Professional Institute* **2 14** 85-91
[3] Kuvshinov Yu A 2012 Noospheric world view and the problem of the global environmental crisis *Successes of modern natural science* **10** 97-100
[4] Kolosova O Yu 2014 The environmental problem: the global nature of the modern era *Science and Modernity* **32(2)** 129-134
[5] Bogdanova A Yu 2015 Absolute overpopulation of land and relative demographic overcrowding in its individual regions as a global social and environmental problem *Conference Sources Sociosphere* **27** 24-25
[6] Pyrsheva M V 2010 Global environmental problems of the world economy *Economics and management: new challenges and prospects* **1** 382-84
[7] Luzgin V P, But E A 2011 Energy and the problem of "sustainable development" J. *Ecology and Industry of Russia* **10** 40-43

[8] Kondratova E S , Shevchenko A A, Rushkova A V 2015 Ecological and energy problems of the development of the industrial complex of the region *J.News of the South-West State University. Series: Economy. Sociology. Management* **3(16)**196-201
[9] Our common future 1987 *Report of the World Commission on Environment and Development* 412 p [Electronic resource] URL: http://www.un.org/ru/ga/ pdf / brundtland.pdf / (appeal date: 10/16/2016).
[10] Chestina T 2016 Economy of Trust *J. Ecology and Law* **2 62** 35-38
[11] Paramonova N 2016Cyclical economy on the threshold of Russia *J. Ecology and law* **2 62** 28-29
[12] Renewable Energy 2016 *Global Report. Main results* [Electronic resource] URL: http://www.ren21.net/wp-content/uploads / 2016/10 / REN21_GSR2016_ KeyFindings_RUSSIAN.pdf / (appeal date: 10/16/2016).
[13] Renewables 2013 Global Status Report KeyFindings_2013_lowres [Electronic resource] URL: http://www.ren21.net/wp-content/uploads/2015/06/KeyFindings_2013_ lowres.pdf / (appeal date: 10/16/2016).
[14] Renewables 2015 Global Status Report [Electronic resource] URL: http://www.ren21.net/wp-content/uploads/2015/07/REN12-GSR2015_Onlinebook_low1.pdf/ (appeal date: 10/16/2016).
[15] Ozhgihin D V 2012 The role of non-traditional renewable energy sources in solving problems of energy and ecology *J. Power and administration in the East of Russia* **4** 165-70
[16] Kosov Yu V 2011 The relationship of energy and environmental security in the current global economic crisis *J. Management consulting* **2 42** 87-95
[17] Fortov V E and Popel O S 2013 Renewable energy sources in the world and in Russia *Proceedings of the first International Forum "Renewable Energy. Ways to improve energy and economic efficiency REENFOR–2013*" [Electronic resource] URL: http://www.reenfor.org/upload/files/ d1d87377ab5ed5c040331420bc9b0a93.pdf / (appeal date: 10/16/2016).
[18] Osipov V I 2001 Natural disasters at the turn of the 21st century *J. Bulletin of the Russian Academy of Sciences* **71 4** 291-302
[19] Korzh V D 2011 New methodology for solving global environmental problems of the *hydrosphere J. Water: chemistry and ecology* **6** 9-19
[20] Davydov B I, Ushakov B N 2011 Is the paradigm agreement possible: ecology-energy-society *J. Medical, biological and socio-psychological problems of safety in emergency situations* **2** 15-22